



Semester 1 Examination, 2020

Question/Answer Booklet

MATHEMATICS METHODS

UNIT 1

**Section Two:
Calculator Assumed**

Fix student label here

Student Name: _____

Time allowed for this section

Reading time before commencing work:

ten minutes

Working time:

one hundred minutes

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer booklet

Formula sheet (retained from Section One)

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, notes on one unfolded sheet of A4 paper, and up to three calculators approved for use in this examination

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of examination
Section One: Calculator-free	8	8	50	53	35
Section Two: Calculator-assumed	14	14	100	97	65
Total					100

Instructions to candidates

1. The rules for the conduct of examinations are detailed in the Christ Church Grammar School reporting and assessment policy. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
3. You must be careful to confine your answer to the specific question asked and to follow any instructions that are specified to a particular question.
4. Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.
5. It is recommended that you do not use pencil, except in diagrams.
6. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.
7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Section Two: Calculator-assumed**65% (97 Marks)**

This section has **fourteen** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Working time: 100 minutes.

Question 9**(6 marks)**

- (a) In city Z, the fare for a 8.5 km taxi ride is \$16.70 and the fares for all taxi rides are directly proportional to the distance travelled.

Determine

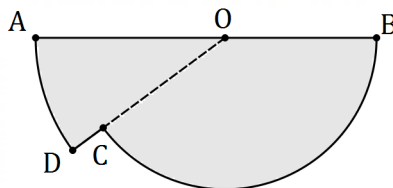
- (i) the fare for a 12 km taxi ride. (2 marks)

- (ii) the distance a fare of \$26.72 would cover. (2 marks)

- (b) A straight line makes an angle of 30° with the positive x -axis and passes through the point with coordinates $(0, 1)$. Determine the exact equation of the line. (2 marks)

Question 10**(5 marks)**

Shape $AOBCDA$ below consists of sector BOC of circle centre O joined to sector DOA of a different circle, also centre O . AB is a straight line of length 65 cm, arc AD is 12 cm long and $\angle AOD = 0.32$ radians.



- (a) Determine the length OA .

(2 marks)

- (b) Determine the area of the shape.

(3 marks)

Question 11

(8 marks)

The height h metres of a particle above level ground is defined as a function of time t seconds as follows:

$$h(t) = 68.75 + 15t - 5t^2, \quad 0 \leq t \leq 5.5.$$

(a) Determine the height of the particle when

(i) $t = 0$. (1 mark)

(ii) $t = 4.5$. (1 mark)

(b) Determine the maximum height reached by the particle and the time it reached this height. (2 marks)

(c) Determine the time(s) that the particle was at a height of 75 m. (2 marks)

(d) State the range of the function $h(t)$ for the given domain. (2 marks)

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Question 12**(6 marks)**

The graph $y = f(x)$, where $f(x) = x^2 + bx + c$ has a turning point at $(-2, -1)$.

(a) State the equation of the line of symmetry for the graph of $y = f(x)$. (1 mark)

(b) Determine the value of the constant b and the value of the constant c . (3 marks)

(c) The graph of $y = f(x)$ is translated 3 units to the right and 5 units upwards. Determine the equation of the resulting curve. (2 marks)

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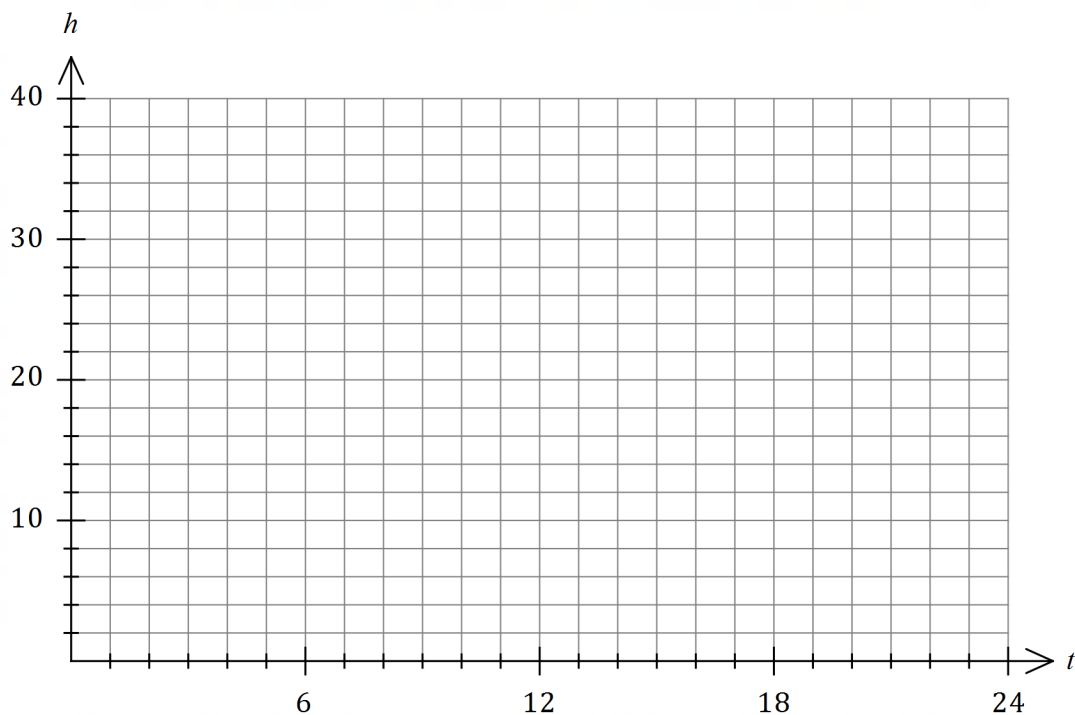
Question 13

(8 marks)

The height above ground level, h m, of a seat on a steadily rotating Ferris wheel t minutes after the wheel begins to move is given by $h = 19.5 + 17.5 \cos\left(\frac{\pi t}{8} + \frac{\pi}{4}\right)$.

- (a) Determine the initial height of the seat. (1 mark)

- (b) Graph the height of the seat against time on the axes below. (4 marks)



- (c) Determine

- (i) the maximum height above ground reached by the seat. (1 mark)
- (ii) the time taken, to the nearest second, for the seat to first reach a height of 5 m above ground level. (2 marks)

Question 14**(10 marks)**

(a) Express

(i) 35° in radians.

(1 mark)

(ii) $\frac{11\pi}{15}$ in degrees.

(1 mark)

(b) A minor segment subtends an angle of 124° in a circle of radius 15 cm.

(i) Sketch a diagram to show the circle and minor segment.

(1 mark)

(ii) Determine the area of the minor segment.

(3 marks)

- (c) In triangle ABC , $AC = 44$ cm, $AB = 35$ cm and $\angle ACB = 48^\circ$. Determine the smallest possible area of the triangle. (4 marks)

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Question 15**(7 marks)**

Let $f(x) = -2 + \sqrt{12 - 2x}$ and $g(x) = 16 + x$.

(a) Evaluate $f(-2) - g(-2)$. (2 marks)

(b) State the domain of $f(x)$. (2 marks)

(c) State the range of $g(x)$. (1 mark)

(d) Determine the coordinates of the point(s) of intersection of $y = f(x)$ and $y = g(x)$. (2 marks)

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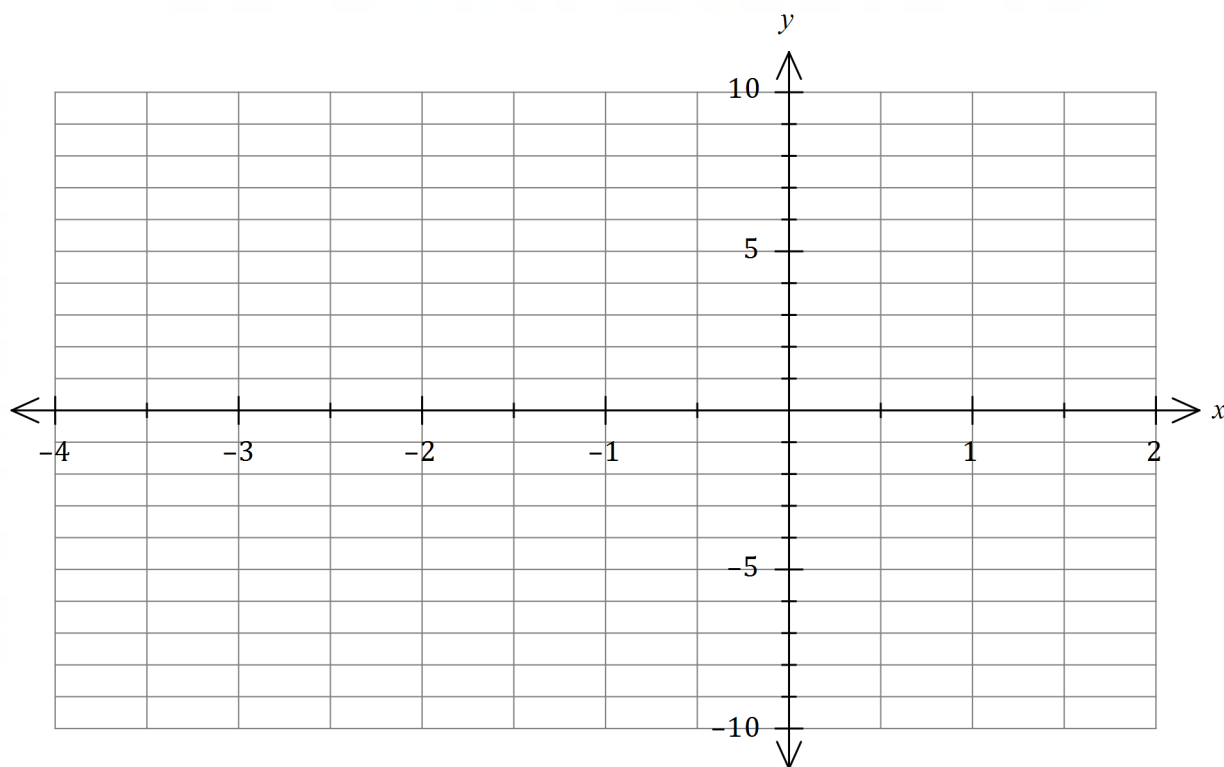
Question 16

(8 marks)

A polynomial of degree 3 passes through the points with coordinates $(0, -3)$, $(1, 0)$, $(-3, 0)$ and $(-0.5, 0)$.

- (a) Determine the equation of the polynomial in expanded form. (4 marks)

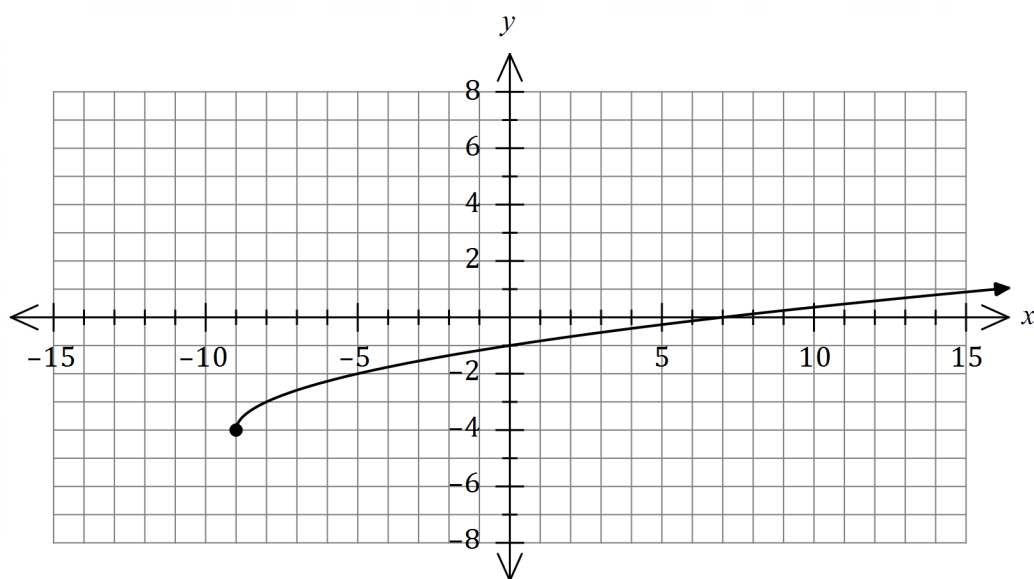
- (b) Draw the graph of the polynomial on the axes below, indicating the coordinates of all turning points. (4 marks)



Question 17

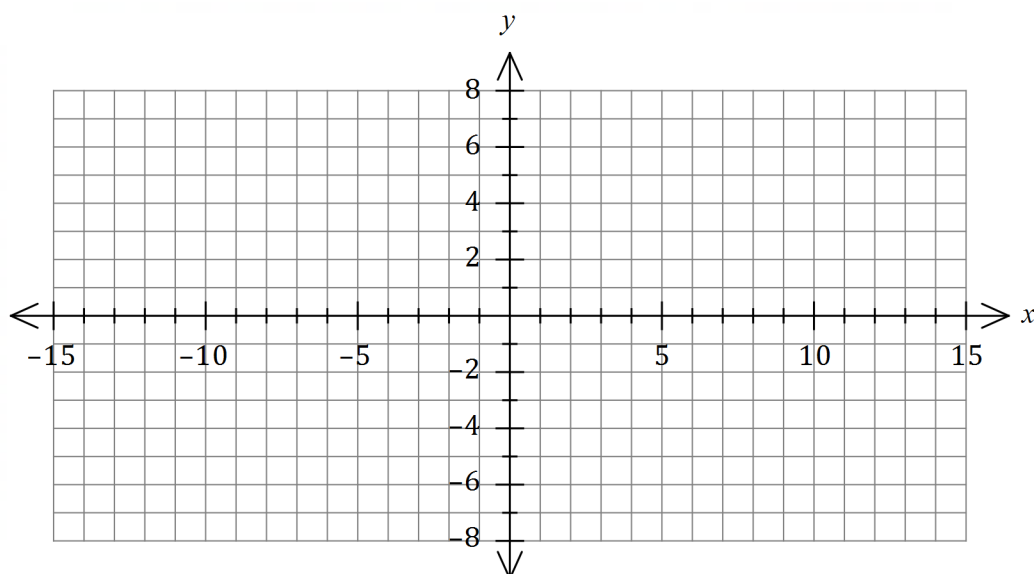
(8 marks)

The graph of $y = f(x)$ is drawn below, where $f(x) = \sqrt{x + a} + b$.



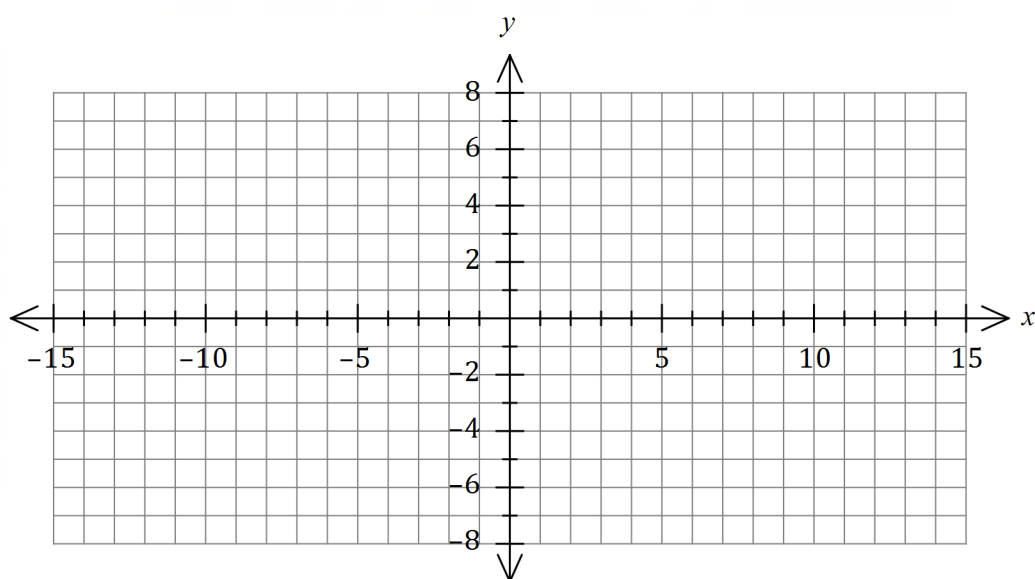
- (a) Determine the value of the constant a and the value of the constant b . (2 marks)

- (b) Draw the graph of $y = -2f(x)$ on the axes below. (3 marks)



(c) Draw the graph of $y = f(2x)$ on the axes below.

(3 marks)



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Question 18

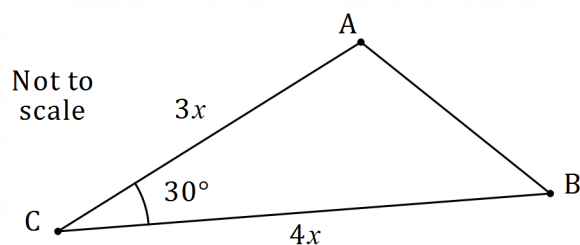
(8 marks)

- (a) Determine the area of triangle PQR when $\angle PQR = 32^\circ$, $\angle PRQ = 114^\circ$ and $PQ = 37$ cm.

(4 marks)

- (b) The area of triangle ABC is 75 cm^2 , $\angle ACB = 30^\circ$ and $3BC = 4AC$ as shown in the diagram. Determine the length of AB .

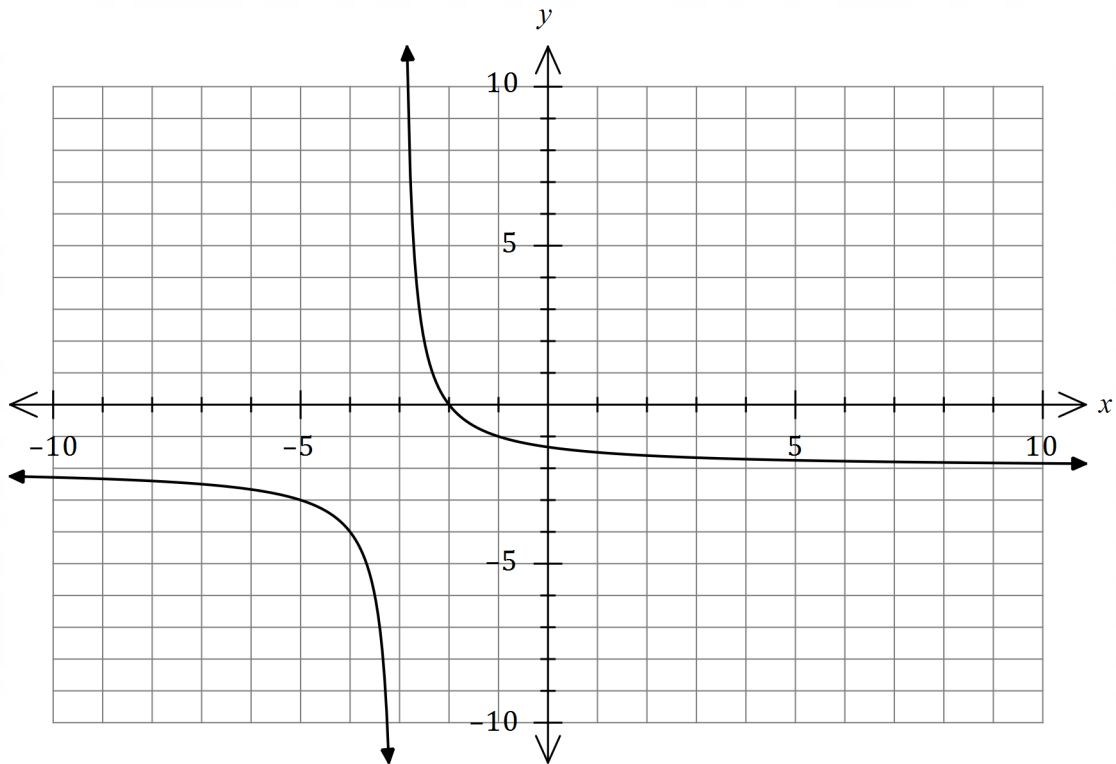
(4 marks)



Question 19

(5 marks)

The graph of $y = f(x)$ is shown, where $f(x) = \frac{a}{x+b} + c$ and a, b and c are constants.



- (a) Determine the value of a , the value of b and the value of c .

(3 marks)

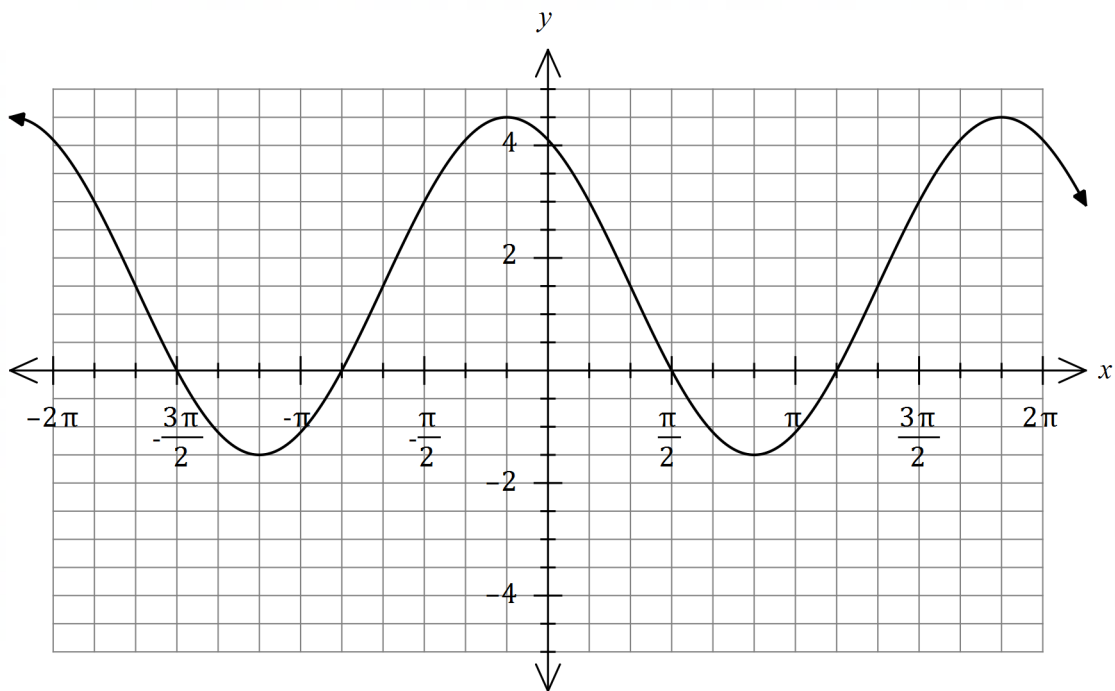
- (b) State the domain and range of $f(x)$.

(2 marks)

Question 20

(8 marks)

The graph of $y = a + b \cos(x + c)$ is drawn below, where a , b and c are positive constants.



- (a) Determine the value of a , the value of b and the value of c , where $c < \pi$. (3 marks)

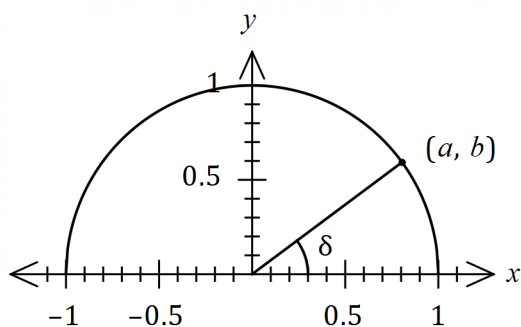
- (b) On the same axes, draw the graph of $y = a + \frac{b}{2} \cos(x - c)$. (3 marks)

- (c) Solve $b \cos(x + c) = \frac{b}{2} \cos(x - c)$ for $-\pi \leq x \leq \pi$. (2 marks)

Question 21

(5 marks)

Consider part of the unit circle shown below.



Determine, in terms of a and/or b , an expression for each of the following

(a) $\cos \delta^\circ$. (1 mark)

(b) $\sin(180^\circ - \delta^\circ)$. (1 mark)

(c) $\cos(90^\circ - \delta^\circ)$. (1 mark)

(d) $\sin(2\delta^\circ)$. (2 marks)

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Question 22**(5 marks)**

- (a) A box of chocolates contains nine different chocolates. Determine the number of different selections that can be made when
- (i) two chocolates are chosen from the box. (1 mark)
- (ii) one, two or three chocolates are chosen from the box. (2 marks)
- (b) (i) Determine the value of r if $\binom{9}{3} = \binom{9}{r}$ (1 mark)
- (ii) Explain how Pascal's triangle can be used to find the solution to part (i). (1 mark)

Supplementary page

Question number: _____

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